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Suggestions for Spraying

By permission of The Deming Co., Salem, Ohio

W. E. Rumsey, N. J. Giddings and A. L. Dacy.

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Photo by F. E. Brooks

Bradshaw plums saved from brown rot and curculio by proper spraying.

Suggestions for Spraying

W. E. RUMSEY, N. J. GIDDINGS AND A. L. DACY

There can no longer be any reasonable doubt as to the value of spraying to prevent or control the injuries to fruits and vegetables, due to the work of fungous diseases and insect pests. It is rapidly taking its place as an essential practice in good farm and orchard management.

There are several problems which confront the man who wishes to begin the practice of spraying that seem difficult and perplexing. This Station is constantly in receipt of inquiries which may be grouped under the questions "How, when and with what shall I spray my crops?" and "where can I obtain the necessary apparatus and material?"

This bulletin has been prepared for the purpose of answering these questions as definitely and as clearly as possible and by so doing help to extend and make more effective the use of the spray pump. It presents nothing original, but seeks to include what scientific investigators and practical orchardists have found to be, up to the present time, the best methods of fighting plant diseases and injurious insects.

Some study of the following pages and the application of what one learns therein will clear up the confusing details and make spraying one of the most profitable, if not the most pleasant of farm operations. "Experience is the best teacher" and "practice makes perfect."

There are a few general statements regarding the practice of spraying to which the beginner's attention is called. To be successful, spraying must be done,

1st. *Intelligently.* Strive to know what you are spraying for. That is "What is the disease and what is the insect you are trying to destroy?" It is not necessary that you should know their life histories, but you should become familiar with the appearance and the common name of our common insect and fungus foes, and the remedy for each.

2nd. *At the proper time.* Spraying is largely preventive.

The spray, if it is to be most effective, must be placed upon the plant before the spore germinates or the insect begins to feed. Learn the proper time for each application.

3rd. *Thoroughly.* All parts of the plant must be covered with the spray solution so that no spore or insect shall escape to reproduce its kind.

Equipment Needed for Spraying

This will vary, of course, with the kind and amount of spraying to be done, but the following list is suggestive. Spray pump spray barrel or tank, hose, extension rods, nozzles, strainer, gallon measure, small pair of scales, several pails and some 50 gallon barrels if stock solutions of Bordeaux are used. A monkey wrench, alligator wrench, screw driver and other accessories are often needed.

A question very frequently asked is: "What kind of a pump shall I buy?" This can be answered in a general way only, as there are so many varying factors which influence the choice. The usual desire of the beginner is to get as cheap an outfit as possible, and naturally the dealer seeks to fill the demand, with the result that the buyer is often disappointed and discouraged because of his poor results. It is economy to buy the best pump obtainable consistent with the amount of spraying to be done. The various classes of pumps will be described briefly. All working parts of the pump should be of brass.

Bucket pumps, knapsack pumps, small compressed air sprayers. Sutable only for a small area of vegetables or small fruits of a few young trees. The latter class is the most desirable of the three.

Small capacity barrel pumps. Suitable for small home orchards, but slow in operation.

Medium capacity barrel pumps. With a little more power, increased effectiveness and a wider range of usefulness.

Large capacity barrel pumps. The best all around spray outfit except for extensive orchards. Will answer the purpose in such while young and are very desirable to have in large orchards in addition to a power outfit. Can be used in 50 gallon barrel or 100 gallon tank. Can be equipped with one or two leads of hose. For steep land should be mounted on the side of the barrel. Will handle orchards up to 500 trees 20 years of age.

Large capacity hand pumps. Horizontal lever type. These are mounted outside of the barrel or on top of tank and connected

to them by a suction hose. Intermediate in capacity between the barrel pump and the power outfit.

Gasolene power outfits. Desirable for orchards of 1,000 trees or over. A great variety on the market, varying from 1½ to 3½ horse power. Ask manufacturers for the names of growers nearest you who are using their machine and get their opinions before ordering.

Traction power sprayers. This class of power outfits are not adapted for general orchard spraying, as a rule, but are designed more particularly for spraying vineyards, potatoes and other field crops and for destroying weeds. They obtain their power from the wheels by means of cams, eccentrics, chains or gears.

Compressed air sprayers. For extensive orchards this type of a spraying outfit offers many advantages. The part of the outfit used in the field consists of two steel tanks (similar to the hot water tanks used in houses) of whatever capacity desired, from 50 to 200 gallons, mounted on a wagon body. One of the tanks holds the spray liquid and the other the air. The air in the latter is compressed by means of a compressor, operated by a gasolene engine located at the central mixing station. This is done while the spray tank is being filled. When ready to spray the operator turns a valve which connects the air tank with that containing the liquid and allows the material to be forced out. The first cost of such an outfit is somewhat greater than that of a gasolene outfit having an equivalent daily capacity. They are lighter than the latter, however, which is a very important factor in spraying hilly orchards. The cost of the field outfit is comparatively small. By having duplicate sets of the tanks, one set can be filling while the other is being emptied, the simple changing of the hose connections from one to the other allowing the operators to continue with their spraying.

Spray hose. A very common mistake is to get too little hose. Each lead should be at least 20 ft. long—25 to 30 ft. is better.

Extension rods. These may be of galvanized iron pipe which may be bought of the local plumber or gas fitter at about 5c a foot, or they may be bought of the spray pump dealer. Bamboo extension rods from 8 to 12 feet long (lined with brass or aluminum pipe,) while expensive, are much lighter and easier to handle, permitting the operator to do better work with less fatigue. All extension rods should be provided with a shut off cock between the end of the hose and the pipe. This gives the

operator instant control over the spray and prevents waste of material.

Nozzles. Each manufacturer has a variety of styles. The three common types in use are the Vermorel, the Bordeaux and the large disc type, or modification of these.

The Vermorel throws a fine mist like spray. Suitable for a small capacity pump and small orchards. Too slow for more extensive work. Clogs easily and projection catches in branches.

The Bordeaux nozzel can be regulated so as to throw a solid stream or a narrow to wide fan-shaped spray. Useful in spraying tall trees and in forcing the spray into the calyx cups in coddling moth spray. The projection of the regulating device bothers sometimes by catching in branches.

The large disc type such as the Friend, Mistry Jr., Simplex, Vapo, etc., is the most desirable for general spraying where 100 pounds or more pressure can be maintained. They are light, do not clog easily, offer no obstruction to the branches and reduce the time expense in spraying.

A Strainer may be made of number 50 brass wire, 30 meshes to the inch, or of several thicknesses of cheese cloth. It will save much time in preventing clogging of the nozzles if all material is strained before placing in the spray tank.

Accessories. Among the additional items of equipment that will be found useful may be mentioned rubber discs to attach to spray rods to protect the operators from leaky nozzles; Sherman hose clamps and hose couplings; reducers for connecting one-half inch hose to quarter inch pipe; pressure guage; a discharge "Y" to fit a pump for either one or two leads of hose; a "Y" enabling the use of two nozzles to a lead of hose, a supply of rubber washers for hose couplings; and an angle attachment between nozzles and end of spray rod enabling operator to direct the spray directly against the tree.

Remedies for the More Common Diseases and Insects.

APPLE

Disease or Insect.	Remedy	First Treatment	Other Treatments	Character of Trouble.
Scab.	Lime-sulphur or Bordeaux mixture	Just as leaves are unfolding	Soon after blossoms fall	Olive-gray spots on foliage and fruit
Bitter rot.	Bordeaux Mixture. Prune out cankers	About two months after petals fall	2 or 3 weeks later and repeat if necessary	Brown sunken spots on fruit.
Leaf spot	Lime-sulphur or Bordeaux Mixture	Soon after blossoms fall	Two or three weeks later and repeat if necessary	Brown spots on leaves
Orange or Cedar rust (see note)	Lime-sulphur or Bordeaux Mix.	When cedar apples begin to swell on cedars.		Small orange spots on leaves and large ones on fruit.
Twig blight	Prune off diseased twigs well back and apply corrosive sublimate to wounds	Whenever noticed		Brown leaves clinging to twigs and shrunken bark.
Canker	Prune out where possible. Cut out and paint over	At any time when pruning		There are several forms of canker, all showing some dead bark and ruptures in it.
Hairy root and Crown gall	Don't accept or set out affected trees			Rough enlargements at or below crown and frequently masses of fine hairy roots

(NOTE)—Spraying for cedar rust has given variable results at different times and places, but we believe it may be controlled by careful spraying at the proper time.

Remedies for the More Common Diseases and Insects.

APPLE

Disease or Insect	Remedy	First Treatment	Other Treatments	Character of Trouble.
Sooty blotch or fly speck	Lime-sulphur or Bordeaux Mixture.	Six weeks to two months after petals fall	2 or 3 weeks later if necessary.	Dark specks and patches on fruit.
Codling moth	Arsenate of lead	Just after petals have fallen	About ten weeks later	Wormy apples.
Canker worm	Arsenate of lead. Tree tangle foot.	Band tree trunks when leaves are unfolding	Spray when larvae appear	Foliage eaten.
Curculio	Arsenate of lead	Just after bloom drops		Knotty fruit.
Borers	Cut out. Use knife and wire	Spring	Fall	Borings at base of tree.
San Jose scale	Lime-sulphur or Soluble oil	When trees are dormant		Bark ashen gray. Limbs die back.
Oyster shell scale	Lime - sulphur soluble oil and Kerosene emulsion	When trees are dormant	When eggs hatch in spring with kerosene emulsion	Small oyster-shell-like objects on the bark.
Scurfy scale	do	do	do	Small whitish pear-shaped objects on the bark.
Woolly aphis	Kerosene emulsion. Tobacco decoction.	Spring	Summer	White woolly patches on trunk or branches. Knotty excrescences on roots.
Green aphis	do	Unfolding of the leaves		Curled conditions of foliage during summer.

Remedies for the More Common Diseases and Insects.

PEAR

Disease or Insect	Remedy	First Treatment	Other Treatments	Character of Trouble.
Scab	Bordeaux or lime-sulphur	Just as leaves open	Just after blossoms fall	Dark olive spots on fruit and leaves. Fruit often cracked.
Fire blight	Frequent pruning and spraying	Prune any time diseased twigs are noticed, cutting well back and disinfecting cut surface with 1-1000 corrosive sublimate		Dry brown leaves clinging to twigs and shrunken bark.
Leaf blight	Bordeaux Mixture or lime-sulphur.	Same treatment as for scab.		
Blistermite	Lime-sulphur	When buds are swelling with strong spray	Just after bloom falls, weak spray	Spotted foliage.
Codling moth	See under apple			
Curculio	See under apple			
San Jose scale	See under apple			

Remedies for the more Common Diseases and Insects.

PEACH

Disease or Insect	Remedy	First Treatment	Other Treatments	Character of Trouble.
Brown rot	Self boiled lime sulphur. Destroy rotted fruit	Four weeks after petals fall	About one month later and one month before fruit ripens	Rotted fruit covered with light brown pustules.
Scab	Self boiled lime sulphur	do	do	Olive colored spots on fruit.
Curl	Strong Bordeaux mixture or lime-sulphur	One to four weeks before buds start		Leaves curled and distorted.
Yellows	Dig out and destroy.	As soon as noticed		Early opening of buds, premature ripening and red spotting of fruit.
Mildew	Self boiled lime sulphur.	As soon as noticed		Whitish growth on leaves and twigs
Curculio	Arsenate of lead	When flower husks have dried		Knotty wormy fruit.
San Jose scale	See under apple			
Borers	Cut out, use knife and wire	Spring	Fall	Borings at base of tree.

Remedies for the more Common Diseases and Insects.

PLUM

Disease or Insect.	Remedy	First Treatment	Other Treatments	Character of Trouble.
Brown rot	Self boiled lime sulphur. Destroy rotted fruit	Three or four weeks after petals fall	About one month later	Rotted fruit covered with light brown pustules.
Scab	See under peach			
Black knot	Thorough pruning, Bordeaux mixture, lime sulphur.	In early spring before buds start	About one month later	Large black warty growths on branches
Curculio	Arsenate of lead. Jarring on sheets	Spray after bloom falls; now begin jarring each morning, continue 4 weeks.		Stung fruit.
San Jose scale	See under apple			

Remedies for the More Common Diseases and Insects.

CHERRY

Disease or Insect	Remedy	First Treatment	Other Treatments	Character of Trouble.
Brown rot	See under plum		Omit second spraying	
Black knot	See under plum			
Powdery mildew	Self boiled lime sulphur or Bordeaux Mixture	After leaves have expanded	3 or 4 weeks later	Whitish growth on leaves and young twigs.
Leaf spot	Self boiled lime sulphur or Bordeaux mixture	When leaves are expanding	3 or 4 weeks later	Reddish spots on leaves which often drop out.
Curculio	See under apple			Wormy fruit.
Rose Chafer	Arsenate of lead.	Soon after blossoms fall		Fruit eaten.
San Jose scale	See under apple			

Remedies for the More Common Diseases and Insects.

GRAPE

Disease or Insect.	Remedy	First Treatment	Other Treatments	Character of Trouble.
Black rot	Bordeaux mixture. Destroy diseased fruit	When shoots are 8-12 inches long.	Repeat every 16-18 days till 5 applications have been made.	Fruit turns black and drops off or shrivels and becomes covered with black pustules. Also brown spots on leaves and stems
Downy mildew	do			White downy spots on under side of leaf. Fruit rots, covered with white growth.
Powdery mildew	Bordeaux mixture or sulphur powder	When shoots are 8-12 inches long	After blossoming and repeat if necessary.	Grayish white powdery spots on leaves and stems; hard spots on fruit.
Grape-vine flea beetle	Arsenate of lead	Before flowers open. Strong mixture.	When grapes are set	Holes eaten in leaves
Grape curculio	Arsenate of lead	Soon after grapes set	2 or 3 weeks later	Wormy fruit.
Rose Chafer	Arsenate of lead and jarring into inverted umbrella catcher	Whenever they occur		Fruit devoured.

Remedies for the more Common Diseases and Insects.

POTATO

Disease or Insect.	Remedy	First Treatment	Other Treatments	Character of Trouble.
Early blight	Bordeaux mixture	When plants are 6-8 inches high	Every two or three weeks.	Brown spots on leaves showing concentric rings.
Scab	Formalin or corrosive sublimate	Just before planting		Rough dark areas in tubers
Tip burn	Bordeaux and thorough cultivation	Same as early blight	Same as early blight	Leaves die at tip and roll up.
Colorado potato beetle	Arsenate of lead or Paris green.	Whenever beetles appear.	When necessary	Tops eaten.
Flea beetle	Arsenate of lead and Bordeaux	do	do	Small holes in leaves.

Photo by W. E. Rumsey

Horizontal lever type of hand pump with home-made potato spraying attachment. Two nozzles to each row.

Spray Materials and Formulae

In general orchard spraying the lime-sulphur solutions are taking the place of Bordeaux mixture to a very great extent. The lime sulphur is less apt to burn the foliage and cause russeting of the fruit than Bordeaux, and its use serves to prevent or keep down the San Jose scale. On the other hand, the lime sulphur solutions are not so effective in controlling all orchard diseases, and it too may sometimes cause burning of the foliage. For a poison, Paris green is fast losing favor, as arsenate of lead is more satisfactory in many ways. The chief points in favor of lead arsenate being that it does not burn the foliage, stays in suspension better and is not easily washed off by showers.

Caution: As most spray materials are either poisonous or have strong caustic properties they should be properly labelled and kept out of reach of children and stock.

Fungicides

Formula No 1.—Bordeaux Mixture.

Copper sulphate (Blue stone or blue vitriol) 3 pounds.
Stone lime (unslaked)----------3 or 5 "
Water ----------50 gallons

Use only lump lime as freshly burned as possible. Air slaked lime should not be used. The copper sulphate will corrode iron or tin. Dissolve in a wooden or stone vessel. For making a barrel (or less) of the material, dissolve the copper sulphate in a pail of hot water, pour into the spray tank and dilute to about 40 gallons. Slake the lime by the addition of the required amount of water and when slaked dilute to about five gallons of water. Pour the milk of lime thus made into the copper sulphate solution in the barrel, passing it through a strainer of brass or cheese cloth. Stir while adding the lime and add water to make 50 gallons of spray material.

Photo by W. E. RUMSEY

A good water supply for spraying. The large tank is filled by gravity from a spring. Water from the main tank is conducted into smaller mixing tanks and the spray tank is filled from these by gravity.

If much spraying is to be done with Bordeaux it is desirable to have a mixing plant. This consists of a platform of such height that its bottom shall be a little above the opening into the spray tank. On the platform may be placed two 50 gallon barrels to hold stock solutions, one of copper sulphate and one of lime. The former is made by suspending 50 pounds of copper sulphate in a burlap sack in the top of barrel filled with water. This may be done at night and it will be all dissolved in the morning. The latter is made by slaking 50 pounds of lime in the barrel and when slaking is completed filling the barrel with water. One gallon of the contents of each barrel, when well stirred will contain one pound of the material in the formula. The platform also supports two other (dilution) receptacles whose added volume equals the capacity of the spray tank. To fill the spray tank the required number of gallons is taken from the copper sulphate stock solution and placed in one of the dilution barrels and the required number of gallons is taken from the lime stock solution and placed in the other dilution barrel. Each is then diluted with the proper amount of water and the two liquids are allowed to run together by gravity, passing through the strainer into the spray tank.

FORMULA NO. 2—STRONG BORDEAUX MIXTURE

Copper sulphate	5 pounds
Stone lime (unslaked	5 "
Water	50 gallons

Prepared same as formula number one. This mixture is for potato, grape and peach leaf curl.

FORMULA NO. 3—SELF BOILED LIME SULPHUR MIXTURE

Fresh Stone Lime	8 pounds
Sulphur, flour or flowers	8 "
Water	50 gallons

The lime should be placed in a vessel and enough water poured on to nearly cover it. Run the sulphur through a sieve to break up the lumps, and preferably mix into a paste with a little water, then add it to the sulphur when the latter is slaking vigorously. Stir occasionally. Keep the vessel covered with gunny sacking, or something of the sort to retain the heat. Add water occasionally to keep the mass in a pastey condition. Stop the boiling as soon as the lime is slaked by adding water to make the 50 gallons, if the material is to be used on peach. When it is to be used on apple let the mass cook twenty minutes after the slaking is completed before adding water to make the 50 gallons.

FORMULA NO. 4—LIME-SULPHUR MIXTURE FOR DORMANT TREES

Fresh lime (unslaked ----------20 pounds
Sulphur ---------- 15 "
Water ----------50 gallons

For the amount mentioned, slake lime and sulphur together in a large iron kettle; dilute to 15 gallons, and boil for an hour. The liquid should then have changed to a reddish-amber color, and will be ready for use. Dilute to 50 gallons with water, and apply while hot. If more than a few trees are to be sprayed, the most satisfactory method of cooking is to use a jet of live steam and cook in barrels or a tank.

FORMULA NO. 5—COMMERCIAL CONCENTRATED LIME-SULPHUR MIXTURE

Concentrated material----------1 gallon
Water ----------9 or 10 gallons

This is the strength recommended for use in spraying dormant trees. For a summer spray use 1½ gallons of the material to 50 gallons of water.

FORMULA NO. 6—HOME-MADE CONCENTRATED LIME-SULPHUR SOLUTION.

Fresh Stone Lime----------40 pounds
Sulphur, flour or flowers----------80 "
Water ----------50 gallons

Place about ten gallons of water in the cooking vessel. Heat the water and add the lime in small quantities at a time. Mix the sulphur into a paste and add it to the lime as the latter begins to slake. When the slaking is completed add the required amount of water and boil vigorously for one hour. If the mixture is made in a kettle sufficient additional water should be added to make up for the amount lost in boiling, say ten gallons. If cooked by steam the additional water is usually not necessary. Unless one has large kettles or vessels in which to make the mixture it is better to make up a half batch at a time. This material can be kept some time by storing it in air tight vessels.

For use against the San Jose scale the density of the diluted solution should be about 4.5 degrees Beaume; for summer spray on apple or pear about 1 degree Beaume.

Hydrometers of the Beaume type can be purchased from the Bausch and Lomb Optical Co., Rochester, N. Y., for about $1.00.

This instrument consists of a weighted, hollow glass bulb or cylinder with a graduated neck. When immersed in a liquid it sinks far enough to displace a bulk of liquid equal to its own

weight, consequently it sinks further in a light than in a heavy solution.

These varying depths are read in degrees on the graduated neck, so we say the density of the solution is so many degrees Beaume.

For testing and diluting lime-sulphur preparations it is necessary to have a hydrometer and a deep glass jar which will hold enough solution to float the hydrometer. The hydrometer cannot detect impurities which may have been added to the solution to increase its density. Such adulterations are rarely met with, and can be determined only by chemical analysis.

The readings on the hydrometer should be made at the general surface of the liquid in which it is supported. After each test, the instrument should be rinsed in clear water to avoid accumulations of the solution. The temperature of the lime-sulphur solution at the time of the test should be about 60 degrees Farenheit.

The lime-sulphur preparations heretofore described are to be used as indicated below:

Formula No. 3—Self-boiled lime-sulphur is recommended especially for use on peach to control brown rot and scab. Apply, as already stated, first after the husk of the bloom has withered and again four weeks later. It is also useful for plum and cherry. Formula No. 4—Lime sulphur mixture for dormant trees. This material is used on all sorts of trees while they are dormant as a remedy for the San Jose scale, preferably just before the buds open in the spring. Formula No. 5—Commercial cencentrated lime-sulphur. This is used for the same purposes as formula No. 4 and is an exceedingly convenient preparation since it is only necessary to add the required amount of water and then apply to the trees. Formula No. 6—Home-made concentrated lime-sulphur solution. This material can be used both as a summer and winter spray by diluting to the required density by the use of a Beaume hydrometer.

Photo by W. E. Rumsey

Brown rot of peach.

Formula No. 7—Corrosive Sublimate

Corrosive sublimate----------4 oz.
Water ----------30 gallons

It is best to dissolve the corrosive sublimate in 2 to 3 gallons of hot water and add this solution while hot to the remainder of the water. This amount is sufficient to disinfect 25 to 30 bushels of potatoes for scab. Metal dishes must not be used for containing any corrosive sublimate solution.

A solution made up with 1 part of corrosive sublimate to 1000 parts of water is used for disinfecting wounds after pruning.

Formula No. 8—Formalin

Formalin ----------1 pint
Water ----------30 gallons

This amount is sufficient for disinfecting about 20 bushels of potatoes for scab.

Formula No. 4—See Fungicides

Formula No. 9—Kerosene Emulsion

Hard Soap----------½ pound
Boiling Water----------1 gallon
Kerosene ----------2 gallons

Dissolve the soap in the water, first cutting it into thin slices to facilitate the process; remove from the stove, add kerosene, and churn through a force pump for 10 minutes. This forms a thick, cream-like stock solution. For use add 1 gallon emulsion to 10 gallons of water. For use on very young tender shoots, add 1 gallon emulsion to 15 gallons of water.

The standard formula for green lice.

Formula No. 10—Tobacco Decoction

Tobacco----2 pounds stems or dust, or 1 pound leaf
Water ----------2 gallons

This is a remedy for plant lice.

Steep the strength from the tobacco and then spray it on the infested plants, or dip them into the liquid. Owing to the different strength of the tobacco used in making this decoction it varies in its effectiveness.

A tobacco decoction known as "Black leaf" manufactured by the Kentucky Tobacco Product Co., Louisville, Ky., is a good material. For plant lice it is used one part to 60 or 65 parts of water.

Formula No. 11—Arsenate of Lead

Lead Arsenate or Disparene----------2 pounds
Water ----------50 gallons

Lead arsenate is in many places taking the place of Paris Green as the standard insecticide, since it remains longer in suspension, does not burn the foliage, and adheres better to the leaf surfaces. Make a thin, smooth paste with the poison and a little water, then add the remainder of the water and stir thoroughly.

In first spray for the grape-vine flea beetle use four pounds of arsenate of lead to fifty gallons of water.

Formula No. 12—Soluble, or Miscible Oil

Soluble Oil (miscible oil)----------1 gallon
Water----------12 to 15 gallons

Photo by W. E. RUMSEY

Properly sprayed apple trees. Photograph taken late in September. Note dense foliage.

For the benefit of those who may contemplate the purchase of a spray outfit or spray material the following lists of reliable firms manufacturing such, are given.

SPRAY PUMP MANUFACTURERS*

Goulds Mfg. Co.....Seneca Falls, N. Y.
The Deming Co.....Salem, Ohio.
Field Force Pump Co.....Elmira, N. Y.
Hardie Mfg Co.....Hudson, Mich.
Bean Spray Pump Co.....Cleveland, Ohio.
F. E. Myers & Bro.....Ashland, Ohio.
E. C. Brown Co.....Rochester, N. Y.
Spraymotor Co.....Buffalo, N. Y.
H. L. Hurst Mfg Co.....Canton, Ohio.
Wm Stahl Sprayer Co.....Quincy, Ill.
Friend Mfg Co.....Gasport, N. Y.
Morrill & Morley.....Benton Harbor, Mich.
Barnes Mfg Co.....Mansfield, Ohio.
R. H. Deyo & Co.....Binghampton, N. Y., Power outfits only.
The New Way Motor Co.....Lansing Mich., Power outfits only.
Bateman Mfg Co.....Greenloch, N. J. Potato Sprayers.
Aspinwall Mfg Co.....Jackson, Mich. Potato Sprayers.
Pierce-Loop Co.....Northeast, Pa. Compressed Air Sprayers.

MANUFACTURERS OF SPRAY MATERIALS*

Grasselli Chemical Co.....Pittsburg, Pa. & Cleveland, O.
Thomsen Chemical Co.....Baltimore, Md.
Horticultural Chemical Co.....Philadelphia, Pa.
Sherwin, Williams Co.....Cleveland, Ohio.
Rex Co.....Omaha, Neb., Conc. Lime-Sulphur Solution.
Merrimac Chemical Co.....Boston, Mass., Arsenate of Lead
Hemingway & Co.....New York N. Y., Arsenate of Lead.
B. G. Pratt Co.....New York, N. Y. Scalecide, Sulphocide.
Bowker Insectitide Co.....Boston, Mass.
Vreeland Chemical Co.....New York, N. Y.
Batelle & Renwick.....New York, N. Y. Sulphur.
Bergenport Sulphur Works.....New York, N. Y. Sulphur.
The Kentucky Tob. Product Co.Louisville, Ky. Tobacco Extracts.

*NOTE.—Except where stated, the above mentioned firms handle a general line of spray apparatus and material.